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The Status and Evolution of the BWA Marketplace

Worldwide Frequency Outline

World-Wide Regulatory Bands - > 20 GHz, Point to Multipoint			
Country	Frequency	Bandwidth	No. of Operators
USA	24 GHz	200 MHz to 40 MHz, one-way	1 operator
	LMDS Block A	28, 29, 31 GHz, 1150 MHz total	1 operator
	LMDS Block B	31 GHz, 150 MHz total	1 operator
	38 GHz	N X 50Mhz paired blocks	2, 3 operators
	40 GHz	Future	1 assumed
	60 GHz	Future	1 assumed
Canada	LMCS	25-28 GHz, 1 GHz chunks	3 operators
	38 GHz	Future	2 operators assumed
Japan	23 GHz - 28 GHz	Variety of bandwidths	2 operators expected
Europe	26 GHz	Various between countries	1
	40 GHz	3 GHz of bandwidth	2 operators expected
	28 GHz	LMDS Equivalent	1
Korea	22, 23, 24, 26	?	?
Asia	23 to 28 GHz	Various band plans	?

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USA Bandwidth per Frequency Block

The spectrum available to the operator will limit the service offering which they provide. That limitation is not the same.

USA Bandwidth per Frequency Block		
Assume 4QAM Modulation @ 1.5 b/s/Hz		
24 GHz	200 MHz to 40 MHz, one-way	300 to 60 Mbps
LMDS Block A	28, 29, 31 GHz, 1150 MHz total	862 Mbps
LMDS Block B	31 GHz, 150 MHz total	115 Mbps
38 GHz	N X 50 MHz paired blocks	N X 75 Mbps
40 GHz	Future	?
60 GHz	Future	?

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Service Possibilities

Possible services offered using Point-to-Multipoint BWA networks include:

TDM Legacy Services (DS0, DS1, structured DS1)
- Typically symmetrical services

IP Application Based Offerings
- In this case, it may make sense to offer raw IP over the air for termination into IP infrastructure.
- IP application offering may be highly asymmetrical, with different bandwidth requirements in both directions.

ATM Application Based Offerings

Video Broadcast / Multicast Offerings

High Availability Systems with wireless used as backup for existing wireline

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Low Frequency Systems

MMDS (2.5-2.7 GHz) systems

Recent FCC ruling allows two-way applications within MMDS bands

Low frequency systems below 10 GHz are much different than high frequency systems >20 GHz.

- Multipathing
- Foliage Penetration
- Equipment Cost Curves
- Antenna Size
- Rain and Weather Effects
- In-Building Penetration
- Microwave Power available

Note that PCS frequencies are at 2 GHz, and so mobility now becomes a possibility for this frequency band.

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Other Wireless Standards and Activity

Narrowband - 64 Kbps voice
Wideband < 2 Mbps, third-generation
Broadband > 2 Mbps

Third-Generation

2 standards are developing, one from Qualcomm and the other from the rest of the industry

GSM, Digital Cellular, PCS would like to have fixed terminals as well for the low bandwidth user. Standards like CDPD and others will evolve for these applications.

Therefore, when we look at the N-WEST standards activity around BWA, do we target wideband and broadband, and therefore compete with 3-G standards evolution?

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Application Domain

Wireless is typically used for mobility. Typically call handoff (session handoff) is a requirement.

BWA systems at the frequencies above 20 GHz are for fixed users, and typically are building to building using Line of Sight links. Hand-off is not required.

The BWA systems at low frequencies below 10 GHz are for fixed users also, but may evolve into mobility.

Portable users (who move around during non-transmission but are fixed during transmission) may be possible at high frequencies.

Nomadic users (who move within a cell coverage area during transmission so that hand-off is not required) need multipath design but not hand-off.

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Conclusions

Standards activity with respect to Broadband Wireless Access (BWA) systems must recognize that different system operators will have different service plans, simply due to competitive pressures within the marketplace.

Customers will be biased towards IP, ATM or other methods.

The standard will probably compete poorly with the future 3G standard, and therefore should be designed for the support of the upper range of narrowband operation.

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